CLAIMS

1. An acoustic sensor comprising:

at least one resonant element;

a driver comprising an electrical coupling means and an electromagnetic field source, arranged such that, in use, the electrical coupling means transfers current to the electromagnetic field source which produces an electromagnetic field that drives the at least one resonant element to produce acoustic waves directed to a predetermined part of a test sample;

an electromagnetic detector arranged to receive, in use, the acoustic spectrum emitted from the test sample after the acoustic waves have interacted with the test sample; and

an electrical circuit connected to the driver and electromagnetic detector, the circuit arranged, in use, to provide the current and to detect, in combination with the electromagnetic detector, the acoustic spectrum received by the electromagnetic detector.

2. A sensor according to claim 1, wherein the electronic circuit comprises an electrical oscillator.

3. A sensor according to claim 1, wherein the electronic circuit comprises a frequency modulated signal generator, an AM diode detector and a lock-in amplifier.

4. A sensor according to any preceding claim, wherein the electromagnetic field source and the electromagnetic detector are the same member.

5. A sensor according to any preceding claim, wherein the electromagnetic field source is single wire.

6. A sensor according to any of claims 1 to 4 wherein the electromagnetic field source is a coil.

7. A sensor according to claim 6, wherein the coil is spiral.

8. A sensor according to claim 6 or claim 7, wherein the coil is copper.

9. A sensor according to claim 7 or 8, wherein the coil is formed from wire wound into a flat spiral element.

10. A sensor according to any of claims 1 to 4, wherein the electromagnetic field source is a microwave horn.

11. A sensor according to any of the preceding claim, wherein the electromagnetic detector is single wire.

12. A sensor according to any of claims 1 to 10, wherein the electromagnetic detector is a coil.

13. A sensor according to claim 12, wherein the coil is spiral.

14. A sensor according to claim 12 or claim 13, wherein the coil is copper.

15. A sensor according to claim 3 to 14, wherein the coil is formed from wire wound into flat spiral element.

16. A sensor according to any of claims 1 to 10, wherein the electromagnetic detector is a microwave horn.

17. A sensor according to any of claims 1 to 16, wherein the resonant element is metal.

18. A sensor according to any of claims 1 to 17, wherein the resonant element is magnetostrictive.

19. A sensor according to any of claims 1 to 16, wherein the resonant element is piezoelectric.

20. A sensor according to any preceding claim, wherein the resonant element is a composite of at least two different materials.

21. A sensor according to any preceding claim, wherein the test sample is in the gaseous phase.

22. A sensor according to claim 21, wherein the resonant element is coated with a polymer layer.

23. A sensor according to any preceding claim, wherein the test sample is in the liquid phase.

24. A sensor according to any preceding claim, wherein the electrical coupling means is a multiply resonant transmission line.

25. A sensor according to any preceding claim, wherein the resonant element is coated with a biorecognition layer.

26. A sensor according to any one of the preceding claims, wherein in use, the sensor detects cells.

27. A sensor according to any of claims 1 to 25, wherein in use, the sensor detects proteins.

28. A sensor according to any of claims 1 to 25, wherein in use, the sensor detects antibodies.

29. A sensor according to any of claims 1 to 25, wherein in use, the sensor detects nucleic acids.

30. A method for use in acoustic sensing, the method comprising the steps of:

applying a current to an electrical coupling means;

transferring current from the electrical coupling means to an electromagnetic field source;

driving, with an electromagnetic field produced by the electromagnetic field source, at least one resonant element to produce acoustic waves directed to a predetermined part of a test sample; and

detecting with an electronic circuit connected to the electromagnetic field source together with an electromagnetic detector and the electrical coupling means, the acoustic spectrum produced after the acoustic waves have interacted with the test sample.

31. A method according to claim 30, wherein the at least one resonant element produces acoustic waves by electrostriction.

32. A method according to claim 30, wherein the at least one resonant element produces acoustic waves by magnetostriction.

33. A method according to any of claims 30 to 32, wherein the acoustic waves are detected by means of an electrical oscillator tuned to the fundamental or harmonic frequency of the resonant element.

34. A method according to any of claims 30 to 32, wherein the acoustic waves are detected by means of a frequency modulated signal generator, an AM diode detector and a lock-in amplifier.